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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/825,024	04/15/2004	Douglas E. Keiter	SUN 6100	7483

2555 7590 12/29/2006

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EXAMINER	
PETTITT, JOHN F	
ART UNIT	**PAPER NUMBER**
3744	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/29/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

NT

Office Action Summary	Application No.	Applicant(s)	
	10/825,024	KEITER ET AL.	
	Examiner	Art Unit	
	John Pettitt	3744	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11/04/2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) *5-9* is/are allowed.

6)☒ Claim(s) *1-3* is/are rejected.

7)☒ Claim(s) *4* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *4/15/2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

The amendments and arguments presented by the applicant have been duly noted. In view of such, the previous rejections in the first office action have been withdrawn. However, an updated search and further review of the prior art has prompted the presentation of new rejections presented below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimizu et al. (US 7,121,099 B2) in view Sekiya et al. (US 6,161,389).

In regard to claim 1, Shimizu et al. ('099) teach a method of controlling a free piston cryocooler, in order to control the temperature of a mass, comprising the steps of modulating the piston stroke (column 4, lines 11-17) for output cooling power demands requiring a piston stroke exceeding a selected minimum piston stroke (that stroke which maintains gas bearing operation, column 4 lines 23-29, 37-42); maintaining the piston stroke at substantially the selected minimum piston stroke (column 9, line 66- column 10, line 1) for cooling power demands less than the selected minimum piston stroke, maintaining the piston stroke at substantially the selected minimum piston stroke (as it is clear that Shimizu et al. ('099) intend to maintain both the minimum and maximum

limits of stroke length during all phases of operation) but do not explicitly teach modulating the piston stroke as an increasing function of the difference between sensed mass temperature and a command reference input temperature and further do not teach applying thermal energy to the mass while maintaining the minimum piston stroke for cooling power demands less than the selected minimum piston stroke.

However, Sekiya et al. ('389) teach modulating the refrigeration power of a Stirling cryocooler as an increasing function of the difference between a sensed mass temperature (detected temperature) and a command reference input temperature (set temperature) (column 19, lines 31-49; note that one of ordinary skill in the art would have understood the discussion of modulating the power of the Stirling cooler in column 19, lines 31-49 to additionally suggest piston stroke length modulation for free piston Stirling cryocoolers not only modulating the piston speed). In addition, Sekiya et al. ('389) teach applying thermal energy to the cold end of the Stirling cryocooler in combination with modulating the refrigeration power of the Stirling cryocooler to control the temperature of the cold end (column 19, lines 50-61).

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to combine the method of maintaining the operational limits of the free piston Stirling cryocooler of Shimizu et al. ('099) (the minimum and maximum stroke for the purpose of preserving proper gas bearing operation in order to reduce frictional wear of the cryocooler) with the method of temperature control taught by Sekiya et al. ('389) to modulate the piston stroke as an increasing function of the difference between a sensed mass temperature and a command reference temperature

and to additionally apply thermal energy to the mass being cooled for the purpose of enhancing the temperature control precision of the system of Shimizu et al. ('099).

In regard to claim 2, see claim 1.

In regard to claim 3, the heater discussed for claim 1 above applies thermal energy as an increasing function of the difference between the cooling power applied to the mass by the cryocooler at the selected minimum piston stroke (i.e. the cooling provided) and the cooling power demand (cooling needed) because it applies heat as a function of the temperature difference between the set temperature and the detected temperature (column 19, lines 50-61).

Allowable [j1]*Subject Matter*

Claim 4 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 5-9 [j2]are allowed.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Pettitt whose telephone number is 571-272-0771. The examiner can normally be reached on M-F 8a-4p.

If *attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cheryl Tyler can be reached on 571-272-4834. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JFP III
December 19, 2006

CHERYL TYLER
SUPERVISORY PATENT EXAMINER